ADAMS (J.F.A.)

MALARIA IN NEW ENGLAND.

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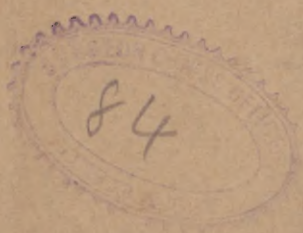

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MALARIA IN NEW ENGLAND.

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A YEAR ago, at the request of the State Board of Health, Lunacy, and Charity, of Massachusetts, the writer of this paper made an investigation of the recent appearance of intermittent fever in that State, the results of which have just been published in the supplementary report of the Board. The investigation involved, of necessity, an extension of the inquiry into the other New England States, especially Connecticut. In the present paper the results will be briefly summarized, and the bearings of the observed phenomena upon the malarial problem stated as succinctly as possible.

The following points will be considered in order: —

1st. The periods when malaria has been present in New England.

2d. The nature of the localities visited.

3d. The rate of progress of the malarial wave.

4th. The subsidence of typhoid fever coincident with the appearance of malaria.

5th. The bearings of the facts observed upon the ætiology of malaria.

I. THE PERIODS OF PREVALENCE.

To the present generation of New Englanders, malarial fevers of home origin have been, until quite recently, wholly unknown. The whole literature of the subject prior to the present epidemic is comprised in a ~~nemo~~ memo- graph by Dr. Oliver Wendell Holmes, published in 1846. The malarial fevers have never been truly endemic in New England, but have been occasional visitants, taking the form of epidemics of a few years' duration. When that portion of the country was first settled fever and ague was one of the common diseases, being apparently incident to the clearing off of the forest. The accounts of it, which are very incomplete, and chiefly from non-medical sources, make no mention of it subsequent to the latter part of the seventeenth century, and from this time onward for a hundred years, viz., until the latter part of the eighteenth century, New England enjoyed complete immunity from this disease. In 1793, however, intermittent fever reappeared, and, together with remittent fever and epidemic dysentery, prevailed in certain localities in the western portion of Connecticut and Massachusetts until 1799, when it vanished, and did not again appear until 1828, except in a single locality, viz., Sheffield, Mass., where it seemed to have obtained a foot-hold, for outbreaks occurred three times during this interval

in the years 1806, 1810, and 1820. From 1828 to 1836 was the next period of general prevalence, the same portions of the country being affected as in the previous visitation. From 1836 to 1850 no cases occurred, so far as can be learned, in any portion of New England. But in the latter year, 1850, a few cases began to appear in a swampy locality near New Haven. From this time to 1864 cases continued to appear there and at several other points on the shore of Long Island Sound between New Haven and the boundary of New York. Having established itself upon this base, malaria began, in 1864, a northward invasion, following the rivers in the western half of Connecticut, reaching the Massachusetts line in 1877, and, in the next three years, penetrating almost to the northern border of that State. Since the beginning of this invasion malaria has not disappeared from any locality where it has once obtained a footing, so that it has now prevailed continuously on the southern shore of Connecticut for thirty-one years, in the centre of that State for ten years, and in Massachusetts for four years. In the localities where it first appeared in Connecticut, however, it is said that its influence appears to be on the wane.

No other New England State has yet been visited except Rhode Island, the first cases in that State having occurred near Providence in 1880. Massachusetts, east of the towns bordering the Connecticut River, remained, up to last winter, free from the malarial fevers, the cases being limited to the western half of the State, the great bulk of them being in the counties of Hampden and Hampshire, and most of the remainder in a few scattered localities in Berkshire. Of the cases reported in 1880, 1,344 occurred in Hampden County, 300 in Hampshire, and 287 in Berkshire. Only five cases were reported in Franklin County, so that the northern boundary of Hampshire County, thirty miles north of the boundary of Connecticut, may be stated as practically the northern limit of malaria in the Connecticut Valley. In Berkshire County no considerable number of cases has occurred in any one locality north of New Lenox, which is twenty-five miles from the Connecticut line. The places reporting the largest number of cases are in Hampden County, Springfield, West Springfield, Chicopee, and Holyoke, reporting respectively, 250, 200, 300, and 500 cases, so that three fifths of all the cases in the State occurred in these four contiguous cities — two on the east and two on the west bank of the Connecticut River. In the State of Connecticut a considerable number of deaths from malarial diseases are reported by Dr. Chamberlain, Secretary of the State Board of Health, and he notes an increasing severity of the periodical fevers and a tendency to malarial complication of various other diseases. Up to last winter the cases in Massachusetts were mild, and a single fatal case of congestive chill in West Springfield was the only case reported of death from undoubted malarial disease. No definite information has been gathered as to the present year; but the accounts received indicate a less prevalence of malarial diseases in Massachusetts than in 1880.

2. THE NATURE OF THE LOCALITIES VISITED.

These localities are found to be, with scarcely any exception, on the borders of rivers, or adjacent to swamps, ponds, or artificial reservoirs. The first cases in Connecticut are said, by Dr. Bronson, of New Haven, to have been at Beaver Ponds, a swampy place northwest of that city. In moving northward, the malarial army appears to have sent a detachment up each of the rivers, while scouting parties have been sent across the country, from pond to pond. In high and dry localities it has scarcely been seen, but along the shores of the Connecticut, Housatonic, and Quinnipiac rivers, and their branches, its influence has been profoundly felt. It has thus shown a decided affinity for water. But, even in these localities, there has been a great difference in the degree of intensity of the malarial poison, and the evidence from all sources agrees in indicating that it is not water but mud, which most powerfully influences its development. On the banks of rivers, the greatest number of cases have occurred where there are marshy shores, overflowed in spring and laid bare in summer, especially where low spots or obstructed ditches cause stagnant pools to form which are gradually dried up by the summer sun. Besides these localities, the places most fertile in malaria have been the reservoirs used for water power, which, in Massachusetts and Connecticut, are very numerous and extensive. These reservoirs, which are formed by the construction of a dam, whereby the area of a natural pond is greatly enlarged, are very shallow and only full after the spring freshets. During the summer they become drawn down so as to expose great tracts of oozy bottom, covered with rotting stumps and other vegetable matter. The greater the extent of the exposed surface, the greater, as a rule, has been the prevalence of malarial fevers; and seasons of drought and unusually low water have been found ~~where~~ these fevers have been most prevalent. Such were the summers of 1870, 1876, and 1880, which were characterized by an unusual prevalence and rapid spread of intermittent fever, in 1870 in New Haven and vicinity, in 1876 at and near Hartford, and in 1880 in portions of Massachusetts.

The relation of fever and ague to rivers and ponds is shown by the fact that in Massachusetts, of the eighteen cities and towns reporting more than half a dozen cases in 1880, eleven were on the Connecticut River, comprising all those bordering upon that river in the counties of Hampden and Hampshire, and the remaining six were in Berkshire County, adjacent to reservoirs or to low, swampy places on the shores of the Housatonic, besides one locality of similar nature on the shore of the Hoosick River.

The first place invaded on the Connecticut River was Springfield, in 1870; next, Holyoke, in 1875; and next, Agawam, in 1878. In 1879 cases first appeared in West Springfield, Chicopee, Northampton, Hadley, and Hatfield, and in 1880 in Longmeadow, South Hadley, and Easthampton. Five of these are on the east and six on the west bank of the river, and, outside of these river towns, which in 1870 reported 1,647 cases, only twenty-seven cases were reported in the whole of the remainder of the two counties of Hampden and Hampshire.

In the river towns the first cases always appeared on low ground near the river, or on tributary streams or ponds, and such places have since remained the foci of the largest number of cases.

In Berkshire County the first cases of intermittent fever appeared at New Marlborough in 1874, the next at Sheffield in 1877, and the next at New Lenox in 1878. In 1879 the disease appeared at Great Barrington, Lanesborough, and Cheshire, and in 1880 in Monterey, Otis, Stockbridge, Lee, West Stockbridge, Richmond, Pittsfield, and North Adams. The number of cases has been much smaller than in the valley of the Connecticut, and nearly all of them have occurred in six towns, namely, Sheffield, Great Barrington, New Lenox, New Marlborough, Lanesborough, and North Adams, where the number of cases in 1880 was eighty, sixty, fifty-four, twenty-six, and thirteen respectively. The nature of these six localities is as follows: At Sheffield the cases occurred near a reservoir which is drawn down in summer, and along the Housatonic River, which is here slow and circuitous, and stagnant pools, left by the spring overflow, slowly evaporate in the adjacent meadows; at New Marlborough, in the Konkapot Valley, where are also stagnant pools formed by the overflow of the river; at Great Barrington, near an artificial reservoir formed by damming the Housatonic River; at New Lenox, close to a reservoir similarly formed, which is so extensive and shallow as to expose a great surface of swampy land in summer, and of so small a capacity as to cause large daily fluctuations as to depth; at Lanesborough, on the border of the great Cheshire reservoir; and at North Adams, on swampy land near the Hoosick River.

3. THE RATE OF PROGRESS.

This is found not to have been a regular one from town to town, but the advance has been by a series of invasions, the first attacking a few places at long intervals, the next affecting certain intermediate ones, and the main army following and occupying the country between these first established outposts.

Thus, while previous to 1864 no cases of intermittent fever had occurred beyond five miles from Long Island Sound, suddenly, in 1864, a few cases appeared in Wethersfield, thirty miles north of the Sound, but it was not till 1872 that the next and stronger wave, advancing from town to town, reached Hartford. In 1870 a few mild cases first appeared in Springfield, Mass., thirty miles north of Wethersfield, and the same year the first cases occurred at New Milford, on the Housatonic River, thirty miles north of any place where they had appeared the previous year. In 1874 cases were first observed at New Marlborough, forty miles north of New Milford, the intermediate towns having up to that time escaped, while the adjoining town of Sheffield was not reached till 1877. The next place reached north of Sheffield was New Lenox, distant twenty miles, and the next Lanesborough, ten miles further north.

With the exception of these preliminary leaps the advance of the malarial influence has been at a much slower rate. It took two years for it to creep up the Quinnipiac River, from New Haven to Wallingford, a distance of

twelve miles. Four years later it reached Meriden, six miles further north, while the ten miles between that city and New Britain was spanned in a single year. The journey from New Haven to Hartford was accomplished in eight years, and the distance from the Sound to the Massachusetts line, which varies from fifty-five to sixty-five miles, was crossed in a period of twelve years. After the first general appearance of intermittent fever in Massachusetts, in 1877, it traveled in three years thirty miles northward, while a few scattering cases occurred as far as forty miles from the southern boundary.

The rate of progress may be roughly stated to be from two to thirty miles a year.

As a rule it has been found that the most rapid progress has been made in the hottest and dryest years. At all places the cases in the first year have been few and mild, the disease gathering strength thereafter from year to year.

4. THE SUBSIDENCE OF TYPHOID FEVER.

The characteristic fevers of New England have always been of the typhoid variety, that is to say, continued fevers, accompanied with a local lesion in the glands of the small intestine. These are characterized by a peculiar range of temperature and an eruption on the skin. They are generally of long duration, and attended with diarrhœa, and exhibit a high rate of mortality. An important factor in their production has been shown to be the vitiation of air and drinking water by animal matters in a state of decomposition — such as are apt to collect about dwelling-houses. Whether or not there is a general atmospheric cause, besides these local causes, has never been satisfactorily proved. But, during the past ten years, a marked diminution in the prevalence of typhoid fever has been observed. Physicians generally report these cases as milder, of shorter duration, and with less diarrhœal tendency. This is especially true of the localities which have become malarious.

In Connecticut, the number of deaths from typhoid fever fell off from 458 in 1869 to 252 in 1878, while the deaths from malarial diseases increased from 9 in 1869 to 143 in 1878. In Massachusetts, the population increased from 1870 to 1880 over 22 per cent.; yet the number of deaths from typhoid fever decreased from 1,333 in 1870 to 637, or less than half, in 1879. It rose again in 1880 to 882, two thirds the number in 1870, perhaps for the reason that the summer of that year was very hot and dry, such as is usually fruitful in typhoid fevers. Yet, in comparing the different counties, we find that in Berkshire and Hampshire, where malarial fevers were prevailing, the deaths from typhoid fever, instead of increasing, as in the rest of the State, had still further diminished. Whether or not there is any actual antagonism between these two forms of fever is a question of great interest. That it may be so, evidence is not wanting, in various parts of the United States. Professor Cabell, of Virginia, has published such evidence existing in his own State. But there is another point to be considered, which is, how far the local sanitary work which has been carried on

in New England during the past decade is to receive credit for the subsidence of typhoid fever. Such of us as have been actively engaged upon health boards have flattered ourselves that the fruits of our labors had become apparent. To find that this subsidence is due not to sanitary science but to malaria would be most mortifying.

5. THE BEARING OF THE FACTS OBSERVED UPON THE ÆTIOLOGY OF MALARIA.

The facts observed in New England indicate an undoubted connection between malaria and swampy land, and in the gradual progress along river margins and from pond to pond, lend strength to the germ theory; for the analogy is complete between this progress and the distribution of plants, ~~where~~ whose seeds are wafted by the winds, to fall, germinate, and mature, wherever the proper soil for their development is found.

The theory of Dr. Oldham that the periodical fevers are due wholly to the influence of chill upon constitutions enfeebled by prolonged and excessive heat, appears to be completely overthrown by these observations: First, because the temperature of New England has undergone no marked change, and those portions of Massachusetts and Connecticut where there is no malaria are no cooler than the portions where it exists; and, second, because in those situations which have now become malarious, cases have been abundant as early as the month of April, immediately after the melting of the snow, and while the weather is yet uncomfortably cold. These investigations have not included any microscopic search for the malarial germ. This is a special branch of the subject, which now offers a tempting field for biological research. While Drs. Klebs and Tomasi Crudeli at Rome in 1879, and Dr. Sternberg at New Orleans in 1880, have done most valuable work in this direction, we cannot fail to perceive the force of Dr. Sternberg's suggestion, that, until the inoculation experiments which they performed upon rabbits are repeated upon the human subject, they cannot be deemed convincing.

No preventive measures to check the spread of malaria have yet been adopted in New England. The reservoirs, which evidently tend to promote its development, are so essential to the manufactures, upon which the prosperity of the State largely depends, that the question how far the public weal requires that they should be interfered with is a very delicate one. A case to be tried in Massachusetts next January is likely to develop many interesting facts in this direction. Suit has been brought against a manufacturing company for maintaining a nuisance, because their mill pond has become a focus of intermittent fever. Let us hope that the trial may add something of value to our knowledge of the subject, and that thus Law may become the handmaid of Science.